

REMARKS

I. Information Disclosure Statements

In reviewing the October 6th Office Action and the file for this application, it was noted that two of the PTO-1449 forms which applicants submitted on March 1, 2002 were not returned with the Office Action. Attached hereto as Exhibits A and B are copies of those forms and the Information Disclosure Statements which accompanied the forms, as well as copies of the stamped return postcards for these submissions..

Applicants would appreciate it if the Examiner would acknowledge receipt of these forms and consideration of the references cited thereon by initialing copies of the forms and returning the initialed copies to the undersigned attorney. Applicants assume that the references listed on these forms are part of the file for this application, but if not, the Examiner is requested to contact the undersigned attorney and additional copies of the references will be provided.

In the October 6th Office Action, the Examiner noted that a variety of references have been made of record in this application. These references were cited based on the scope of applicants' independent claims, as well as the specific features of applicants' invention highlighted in the dependent claims. For example, prior to the present amendment, in addition to independent method Claim 1, applicants were also seeking independent product Claim 14 which is directed to a microlens array, however made, having a focusing efficiency greater than 75%:

14. A microlens array comprising a plurality of unit cells and a plurality of microlenses, one microlens per unit cell, said array having a focusing efficiency of at least 75 percent.

U.S. Patent No. 5,080,706, described by the Examiner in the October 6th Office Action as allegedly being merely cumulative and/or peripherally

relevant to the instant claims, discusses microlens arrays at column 10, lines 61-63:

...an array of the laser diode-lens assemblies 72 may be connected together to form an efficient, high-intensity collimated output.

Although this reference does not disclose a focusing efficiency of greater than 75% and thus is not believed to anticipate or render obvious applicants' claims, the reference does discuss the use of its technology to produce an efficient lens array.

With regard to applicants' dependent claims, Claim 6, which is concerned with producing randomized microlens arrays, led to the citation of various of the references of the Information Disclosure Statements. Commonly-assigned U.S. Patent Application No. 60/222,033 (the '033 application), the contents of which are incorporated into this application at page 1, lines 19-25, is also concerned with randomized microlens arrays. Consequently, references made of record in that application have also been made of record in this application (see, for example, Exhibit B hereto which contains the International Search Report for the commonly-assigned PCT application which claims priority from the '033 application).

In view of the foregoing, applicants respectfully submit that based on the scope of the claims originally filed in this application, the references cited in the Information Disclosure Statements properly satisfied applicants' duty of disclosure.

As set forth above, non-elected product Claims 14-23 are being cancelled by this amendment and independent method Claim 1 is being amended to refer specifically to direct laser writing of a photoresist. In view of these changes to the claims, the references previously made of record have been reviewed to identify those specifically relating to direct laser writing of photoresists, as well as those relating to laser scanning, laser

ablation, laser etching, electron-beam scanning, or mechanical methods for forming lens arrays or screen surfaces. A list of the references identified by this review is set forth in Exhibit C. The Examiner is requested to contact the undersigned attorney if any further reviews of the cited references are believed to be necessary or desirable with regard to the pending claims of this application.

II. Restriction Requirement

In response to paragraphs 2-7 of the October 6th Office Action, applicants re-affirm their election of Claims 1-13 for further prosecution in this application. Non-elected Claims 14-23 are being canceled without prejudice to the filing of same in a divisional application.

III. Rejection Under §112, ¶2

As set forth above, Claim 1 has been amended by:

- (a) explicitly distinguishing between (i) the original "photoresist master" and (ii) any "further master" produced from the photoresist master (corresponding amendments have been made to the dependent claims);
- (b) making explicit in subparagraph (d)(ii) that the "further master" has "a surface configuration which is substantially the negative of the surface configuration of the microlens array"; and
- (c) deleting subparagraph (d)(iii).

The original language of Claim 1 was chosen to take into account the possibility of various intermediate steps and/or treatments which can be performed with or on applicants' photoresist master prior to the actual production of a microlens array. The amendments to Claim 1 are believed to cover these possibilities using more succinct language while still providing applicants with the same level of protection for their invention.

In particular, subparagraph (d)(ii) covers the possibility of using an intermediate master (which would not have "a surface configuration which

is substantially the negative of the surface configuration of the microlens array") between the photoresist master and the further master (both of which would have "a surface configuration which is substantially the negative of the surface configuration of the microlens array"). This subparagraph also covers the possibility of applying coatings, e.g., a metal coating, to the photoresist master to produce a further master which would then be used to produce the microlens array. In this case, both the photoresist master and the further master would have "a surface configuration which is substantially the negative of the surface configuration of the microlens array" without the need for an intermediate master which would not have such a surface configuration.

Applicants respectfully submit that their original claim language did satisfy the requirements of §112, ¶2, but that the revised language avoids any possible question in this regard. Because the amendments do not narrow Claim 1 or any of the amended dependent claims, applicants believe that their right to rely on the doctrine of equivalents should not be compromised by these changes to their claims.

IV. The Rejections Under §102 and §103

The following copies of Figures 7A and 7B of this application illustrate why applicants believe that their invention is properly patentable:

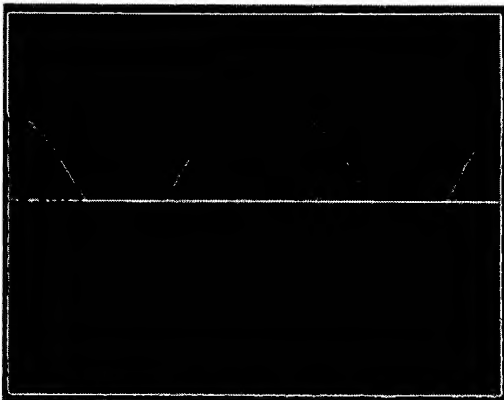


FIG. 7A



FIG. 7B

Figure 7A illustrates what happens when convex microlenses are formed by direct laser writing of the lenses in convex form, while Figure 7B illustrates the marked improvement achieved when, in accordance with the invention, the lenses are first written in concave form and then subsequently reproduced in convex form. Applicants describe the important differences between the two approaches shown in these figures as follows (see page 12, line 25, to page 13, line 6, of the specification):

...FIG. 7A shows the case of an array of microlenses with diameter equal to 50 μm fabricated in convex mode. The boundaries between microlenses are clearly rounded and cannot be efficiently used for focusing. The estimated efficiency for each microlens in this array is 50%.

On the other hand, when the same array is fabricated in concave form one obtains a far better result, as shown in FIG. 7B. Note that the boundaries are preserved. This array is estimated to be 100% efficient in focusing. In addition the concave surface-relief structure can be fully packed without losing efficiency. Direct writing of a convex array cannot achieve such packing without loss of efficiency.

Put simply, none of the prior art discloses or suggests this unexpected improvement in focusing efficiency from 50% to 100% achieved by the production method of the invention. Similarly, none of the prior art discloses or suggests that this improvement in focusing efficiency can be maintained even if the lens structure is fully packed.

To emphasize these features of the invention, independent Claim 1 has been amended to explicitly recite that the positive photoresist is exposed to form a latent image using a direct laser writing process which employs relative movement between a laser beam having a finite beam width and a positive photoresist. The latent image is then developed to form the photoresist master. Support for these amendments to Claim 1 can be found in, for example, Figure 3 of applicants' application and the

discussion of that figure which appears at, for example, page 9 of the specification. In addition to amending Claim 1, additional dependent claims have been added to the application which highlight the combination of high focusing efficiency and high fill factors, as well as the combination of these features with the randomization aspects of the invention.

As discussed at pages 9-12 of the specification and illustrated in Figures 4-6, prior to the present invention, it was believed in the art that it did not make a difference in terms of convolution problems whether microlenses were written in convex or concave form in a positive photoresist using direct laser writing. Accordingly, there was no motivation in the art to complicate the overall process of producing microlenses by first writing a negative of an array of convex microlenses in a positive photoresist and then copying that negative to form the desired lenses. That is, there was no motivation to add additional steps to the process where the desired positive of the convex microlenses could be obtained directly in the photoresist without any apparent downside to doing so.

Applicants acknowledge that the Examiner may be able to find in individual references general disclosures of some of the aspects of the various steps of their invention. However, applicants submit that the art has not previously combined the specific steps of their method in the manner called for by their claims. In particular, applicants submit that none of the references cited by the Examiner in the October 6th Office Action have made this combination, including, the Examiner's primary references (i.e., Hutley, Journal of Modern Optics, and Sugawara et al., U.S. Patent No. 5,085,977). Applicants further submit that there is no motivation to make the combination of steps that they are claiming for at least two basic reasons: (1) none of the cited references (nor to applicants' knowledge any other reference) recognizes that there is a significant advantage to first

making a negative of convex lenses in a positive photoresist using a laser beam and thereafter making the desired convex lenses using that negative; and (2) without such a recognition, the art will use the simplest and most straightforward process, not a more complicated process which uses extra steps for no (as the art perceives it) apparent benefit.

Indeed, applicants submit that the extensive prior art which exists regarding the production of microlenses is itself a testament to the non-obviousness of the present invention. As the old adage goes, if applicants' invention were in fact obvious, it would have been disclosed long ago given the important advantages which the invention provides.

Under these circumstances, applicants respectfully submit that their claims are neither anticipated nor rendered obvious by the prior art. Accordingly, withdrawal of the Examiner's rejections under §102 and §103 is respectfully requested.

V. Conclusion

In view of the foregoing, applicants respectfully submit that the present application is now in condition for allowance. Accordingly, reconsideration and the issuance of a notice of allowance for this application are respectfully requested.

Respectfully submitted,

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